

JOINT PRODUCT AND BY-PRODUCT COSTING

FEATURES OF JOINT AND BY-PRODUCTS

Joint products and by-products arise in situations where the production of one product makes inevitable the production of other products. When a group of individual products is simultaneously produced, and each product has a significant relative sales value, the outputs are usually called '*Joint Products*'.

Those products that are part of the simultaneous production process and have a minor sales value when compared with the joint products are called '*By Products*'. These result incidentally from the main joint products.

Thus Joint products "represent two or more products separated in the course of the same processing operations, usually requiring further processing, each product being in such proportion that no single product can be designated as a major product." By-products have been defined as "any saleable or usual value incidentally produced in addition to the main product." Thus the main difference between by-products and joint product is that in case of the former, generally no extra expense is to be incurred, whereas in the case of the latter additional expenditure will be necessary before the products can be sold.

Another point of distinction is regarding importance. If the various products are of substantial importance, they are termed as joint products.

For example, in the case of a refinery, diesel oil is a joint product when petrol is produced. If the various products differ greatly in importance, the relatively unimportant articles will be by-products such as molasses and bagasse in a sugar factory.

The distinguishing feature of the production of joint and by-products is that the products are not identifiable as different individual products until a specific point in the production process is reached, known as the split-off-point. Before the split-off-point, costs cannot be traced to particular products. After the split-off-point, joint products may be sold or subjected to further processing. If latter is the case, any further processing costs can easily be traced to the specific products involved.

METHODS OF APPORTIONING JOINT COSTS TO PRODUCTS

The methods used to apportion joint cost are based on physical volume and sales value of products.

(1) **Physical Volume Method:** Method assumes to measure benefits received from the joint product costs by the individual products based on *physical measure* such as weights, volume etc.

(2) **Market Value of Products Method.**

(a) *Where by-products are of small value* the effort to calculate their costs is not warranted. Hence either :

- (i) the amount realised (or realisable) may be treated as pure profit and credited to the Costing Profit or Loss A/c; or
- (ii) the amount realised (or realisable) may be credited to the cost of the main product, thus reducing the cost. This method is preferable.

Both the methods are defective because the true cost of the main product cannot be ascertained. In any case the quantity of the by-product must be put on the credit side of the Process Account, so that the total quantity is accounted for.

(b) *Where by-products are of considerable value*, an attempt to find out the cost of each product will be necessary and justified. The total must be apportioned between all products (main and by-products). This will require technical knowledge. Merely to divide the total cost by the number of units of all products will be defective.

Illustration 1: A chemical process yields 70 per cent of the materials introduced as main product and 20 per cent as a by-product, 10 per cent being lost. Technical information reveals that of the materials 75 per cent is absorbed by the main product and 25% by the by-product. One unit of main product needs double the time needed for one unit of by-product and overheads are absorbed in the ratio of 3 : 1.

During a week, 1,000 units of raw materials at a cost of ₹5,000 were introduced. Labour totalled ₹3,200 and overheads came to ₹2,000. Wastage realised ₹200.

Ascertain the cost of the two products.

Solution:

Total number of units produced:

		Units
Main product	70%	700
By-product	20%	200
Wastage	10%	100
Materials introduced		<u>1,000</u>

Cost Sheet

	Basic of Allocation	Main Product (700)		By Product (200)	
		Total ₹	Per unit ₹	Total ₹	Per unit ₹
Materials	75 : 25	3,750	5.36	1,250	6.25
Labour	14 : 2	2,800	4.00	400	2.00
Overheads (₹2000 less ₹200)	3 : 1	1,350	1.93	450	2.25
Total		7,900	11.29	2,100	10.50

Note : Labour is allocated in the ratio of 14:2 because the main product needs double the wages of that required for the by-product. Hence for purpose of allocation of labour, 700 units of the main product are equivalent to 1,400 units of by-products.

(c) *Where the joint products require further expenditure*, such additional expenditure should be added after apportioning joint expenses as explained in (b) above.

(d) An alternative to (c) is to *apportion the common expenses in the ratio of the market value of the various product at the point of separation*. For instance, if X and Y are two products jointly produced and if X sells at ₹10 and Y at ₹8 per unit, the total expenses can be apportioned between X and Y in the ratio of 10 : 8. If the number of units produced are different, the total sale proceeds of each product should be the basis of allocation. This is to say the selling price per unit should be multiplied by the number of units produced.

This method is useful where the subsequent expenditure (*i.e.*, after separation) is disproportionate. Generally, this method will give good results and, therefore, it should be adopted as a rule unless circumstances suggest otherwise.

(e) Another alternative is to apportion the total *common expenditure in the ratio of the market value of the various products when finally ready for sale*. If the expenditure after separation is disproportionate for each product, this method will not give good results. It is therefore, not recommended.

(f) Another method is to deduct from the market value of the by product: (i) the reasonable margin of profit and (ii) the expenditure after separation and then to treat the balance as a reduction of the cost of the main product. Suppose by-product Y realises ₹2,000 after a special or separate expense on it of ₹400 and suppose a profit of 25 per cent on selling price is reasonable in case of this product, then ₹1100 will be credited to the cost of the main product, thus:

	₹
Amount realised by sale of Y	2,000
Less: 25% Profit	500
	1,500
Less: Special or separate expenditure	400
Share out of common costs	1,100

Illustration 2: (*Joint and Separate Exps.*) A By-product 'Beta' is derived in the course of manufacturing a product 'Alpha'. The by-product is further processed for sale. From the following data available from records, prepare accounting showing the cost per kg of the product 'Alpha' and 'Beta'.

	Joint Exps. ₹	Separate Expenses	
		'Alpha' ₹	'Beta' ₹
Materials	10,000	6,000	500
Labour	7,000	5,000	2,000
Overheads	2,500	1,500	600

The quantities produced during the period under consideration were: Alpha, 100 kg; and Beta, 50 kg. The selling price of Beta was ₹120 kg, on which the profit earned was estimated at 30% of selling price.

Solution: The share of joint expenses attributable to the by-product 'Beta' may be calculated as below:

	₹
Selling Price of Beta : 50 kg @ ₹120 per kg (50 × 120)	6,000
Less: Profit 30% of selling price	1,800
Total Cost of Production	4,200
Less: Cost incurred on further processing or separate expenses of Beta—	
Materials	500
Labour	2,000
Overheads	600
Share of Joint Expenses for Beta	3,100
	1,100

**Product 'Alpha' Account
(Output : 100 kg)**

	₹		₹
To Joint Expenses:		By Cost of By-product	
Materials	10,000	(Beta) transferred to Beta	
Labour	7,000	A/c (Joint Exps.)	1,100
Overheads	2,500	By Cost of Production of	
To Materials	6,000	Alpha (Cost per kg ₹309)	30,900
To Labour	5,000		
To Overheads	1,500		
	32,000		32,000

**By-product Beta Account
(Output : 50 kg)**

	₹		₹
To Joint Expenses transferred from Process I (Alpha A/c)	1,100	By Cost of Producing 'Beta' c/d (cost per kg ₹84)	
To Materials	500		4,200
To Labour	2,000		
To Overheads	600		
	4,200		4,200
To Cost of Production b/d	4,200	By Sales (50 kg @ ₹120 per kg)	
To Profit	1,800		6,000
	6,000		6,000

Illustration 3: (Joint and Separate Exps). Two by-products *X* and *Y* are produced in the course of manufacture of Product *A*. Their expenses are as follows:

	Joint Expenses ₹	Subsequent or Separate Exps.		
		<i>A</i> ₹	<i>X</i> ₹	<i>Y</i> ₹
Materials	800	200	100	80
Labour	1,000	300	125	100
On cost	600	300	100	192
	2,400	800	325	372

Selling Prices are : *A*—₹3,000; *X*—₹1,000; and *Y*—₹800. The estimated profits are 20%, 17.5% and 16% respectively on the turnover. Prepare separate accounts showing the cost of each product.

Solution: **Apportionment of Joint Expenses over *A*, *X* and *Y***

	<i>A</i>	<i>X</i>	<i>Y</i>
Selling Price	₹3,000	₹1,000	₹800
Less: Profit on Selling Price	600 [20%]	175 [17.5%]	128 [16%]
Total Cost	2,400	825	672
Less: Seperate Expenses	800	325	372
Share in Joint Expenses	1,600	500	300

A (Main Product) Account

	₹		₹
To Joint Expenses		By <i>X</i> By-product A/c (Share in Joint Exps.)	500
Materials	800	By <i>Y</i> By-product A/c (Share in Joint Exps.)	300
Labour	1,000	By Cost of Production of A (Main Product) c/d	2,400
On cost	600		
To Material	200		
To Labour	300		
To On cost	300		
	3,200		3,200
To Cost of Production b/d	2,400	By Sales	3,000
To Profit (20% on Sales)	600		
	3,000		3,000

X (By-Product) Account

	₹		₹
To Joint Expenses transferred from <i>A</i> (Main Product A/c)	500	By Cost of Production of <i>X</i> (By-Product) c/d	825
To Material	100		
To Labour	125		
To On cost	100		
	825		825
To Cost of Production b/d	825	By Sales	1,000
To Profit (17.5% on Sales)	175		
	1,000		1,000

Y (By-Product) Account

	₹		₹
To Joint Expenses transferred from A (Main Product A/c)	300	By Cost of Production of Y (By-Product) c/d	672
To Material	80		
To Labour	100		
To On cost	192		
	672		672
To Cost of Production b/d	672	By Sales	800
To Profit (16% on Sales)	128		
	800		800

Alternative Method: There may be an alternative method. A Joint Exps. Account is prepared as below:

Joint Expenses Account

	₹		₹
To Materials	800	By A	1,600
To Labour	1,000	By X	500
To On cost	600	By Y	300
	2,400		2,400

A, X and Y Accounts will be prepared accordingly. Allocated joint expenses of each will be debited to these accounts.

Illustration 4: A Company producing an article P also produces by-products Q and R. The cost of manufacture are given below:

	Joint Expenses	Separate Expenses		
		P	Q	R
Materials	10,000	1,100	1,300	1,000
Labour	12,000	200	150	100
Overheads	8,000	800	550	400
	₹30,000	2,100	2,000	1,500
Sales value		28,000	24,000	20,000
Estimated profit on selling price		30%	25%	20%

Show how would you propose to apportion joint expenses of manufacture and prepare necessary accounts relating to P, Q and R.

Solution:

	P	Q	R	Total
Sales	28,000	24,000	20,000	72,000
Less: Profit	8,400	6,000	4,000	18,400
Total Cost	19,600	18,000	16,000	53,600
Less: Separate Expenses	2,100	2,000	1,500	5,600
Share in Joint Exp.	17,500	16,000	14,500	48,000

Since the above shares in Joint Exps. are ₹48,000, while given Joint Expenses are ₹30,000, hence the difference i.e. ₹18,000 will be taken as selling overheads which will be allocated among products in their sales ratio i.e. 28 : 24 : 20 or 7 : 6 : 5.

	<i>P</i>	<i>Q</i>	<i>R</i>	Total
Share in Joint Exp. allocated	17,500	16,000	14,500	48,000
<i>Less:</i> Selling Overheads	7,000	6,000	5,000	18,000
Share in Joint Exp. (given)	10,500	10,000	9,500	30,000

Main Product (P) Account

	₹		₹
To Joint Exps:			
Materials	10,000	By By-product <i>Q</i>	10,000
Labour	12,000	By By-product <i>R</i>	9,500
Overhead	8,000	By Cost of Production c/d	19,600
To Separate Exps.			
Materials	1,100		
Labour	200		
Overhead	800		
To Selling Overheads	7,000		
	39,100		39,100
To Cost of Production b/d	19,600	By Sales	28,000
To Profit	8,400		
	28,000		28,000

By-Product (Q) Account

	₹		₹
To Main Product			
<i>P</i> Account	10,000	By Cost of Production c/d	18,000
To Separate Exps.			
Materials	1,300		
Labour	150		
Overhead	550		
To Selling Overheads	6,000		
	18,000		18,000
To Cost of Production b/d	18,000	By Sales	24,000
To Profit	6,000		
	24,000		24,000

By-Product (R) Account

	₹		₹
To Main Product <i>P</i> Account	9,500	By Cost of Production c/d	16,000
To Separate Exps.			
Materials	1,000		
Labour	100		
Overhead	400		
To Selling Overheads	5,000		
	16,000		16,000
To Cost of Production b/d	16,000	By Sales	20,000
To Profit	4,000		
	20,000		20,000

Illustration 5: In manufacturing the main product *A*, a company processes the resulting waste material into two by-products *M*₁ and *M*₂. You are required to apportion total cost up to separation point among : *A*, *M*₁ and *M*₂ from the following data. Total cost up to separation point was ₹1,36,000.

	<i>A</i>	<i>M</i> ₁	<i>M</i> ₂
(i) Sales	3,28,000	32,000	48,000
(ii) Cost after separation		9,600	14,400
(iii) Percentage of net profit to sales		20%	30%
(iv) Percentage of selling expenses to sales	20%	20%	20%

Solution:

Cost Charged to By-Product

		<i>M</i> ₁ ₹		<i>M</i> ₂ ₹
Sale		32,000		48,000
Less: Profit	6,400		14,400	
Selling Exps.	6,400	12,800	9,600	24,000
Cost of Production		19,200		24,000
Less: Cost after separation		9,600		14,400
		9,600		9,600

Statement Showing Cost and Profit

	<i>A</i>	<i>M</i> ₁	<i>M</i> ₂
Joint Cost	1,36,000		
Less: Charged to <i>M</i> ₁ a <i>M</i> ₂ (as per above statement)	19,200	9,600	9,600
Cost after separation	1,16,800	9,600	9,600
Cost of Production	1,16,800	19,200	24,000
Selling Exps. (20% of Sales)	65,600	6,400	9,600
Total Cost	1,82,400	25,600	33,600
Profit	1,45,600	6,400	14,400
Sales	₹3,28,000	32,000	48,000

Illustration 6: The yield of a certain process is 80% as to the main product, 15% as to the by-product and 5% as to the process loss. The material put in process (5,000 units) cost ₹23.75 per unit and all other charges are ₹14,250, of which power cost accounted for $33\frac{1}{3}\%$. It is ascertained that power is chargeable as to the main product and by-product in the ratio of 10:9. Draw up a statement showing the cost of the by-product.

Solution:

Working Notes :

Material put in process 5,000 units at	₹23.75
	₹1,18,750
Power ($33\frac{1}{3}\%$ of 14,250)	₹4,750
Other charges (14,250 – 4,750)	₹9,500
Joint Cost	₹1,33,000
Main product 80% of 5,000	4,000 Units
By-product 15% of 5,000	750 Units
Process loss 5% of 5,000	250 Units

Statement Showing the Cost of the By-product

<i>Particulars</i>	<i>Total</i>	<i>Main Product</i>	<i>By-product</i>
	₹	₹	₹
Production-Units		4,000	750
Materials (4,000 : 750 units)	1,18,750	1,00,000	18,750
Power (10 : 9 ratio)	4,750	2,500	2,250
Other charges (4,000 : 750)	9,500	8,000	1,500
Total cost	1,33,000	1,10,500	22,500

Illustration 7: JB Limited produces four joint products. A, B, C and D, all of which emerge from the processing of one raw material. The following are the relevant data:

Production for the period:

<i>Joint-product</i>	<i>Number of units</i>	<i>Selling price per unit</i>
		₹
A	500	18.00
B	900	8.00
C	400	4.00
D	200	11.00

The company budgets for a profit of 10% of sales value. The other estimated costs are:

	₹
Carriage inwards	1,000
Direct wages	3,000
Manufacturing Overhead	2,000
Administration Overhead	10% of sales value.

You are required to:

- Calculate the maximum price that may be paid for the raw material.
- Prepare a comprehensive cost statement for each of the products allocating the materials and other costs based upon:
 - number of units
 - sales value.

Solution:

(a) Joint Product Cost

<i>Joint-product</i>	<i>No. of units</i>	<i>S.P. per units</i>	<i>Sales value</i>
			₹
A	500	18	9,000
B	900	8	7,200
C	400	4	1,600
D	200	11	2,200
Total Sales Value			20,000
Less : Budget profit 10% of sales value.			2,000
Joint product cost			18,000
Less: Other costs:			
Carriage inwards	1,000		
Direct wages	3,000		
Mfg. overhead	2,000		
Admn. overhead 10% of sales value	2,000		
			8,000
Raw Material			10,000

Thus maximum price that may be paid for raw material is ₹10,000.

(b) (i) Statement of Cost
(Based upon number of units)

Joint-Products	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>Total</i>
No. of units	500	900	400	200	
	₹	₹	₹	₹	₹
Raw material	2,500	4,500	2,000	1,000	10,000
Carriage Inwards	250	450	200	100	1,000
Direct Wages	750	1,350	600	300	3,000
Mfg. Overhead	500	900	400	200	2,000
Admn. Overhead	500	900	400	200	2,000
Total Costs	4,500	8,100	3,600	1,800	18,000

(b) (ii) Statement of Cost
(Based upon Sales Value)

Joint Products	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>Total</i>
Sales Value	₹9,000	7,200	1,600	2,200	20,000
Raw material	4,500	3,600	800	1,100	10,000
Carriage Inwards	450	360	80	110	1,000
Direct Wages	1,350	1,080	240	330	3,000
Mfg. Overhead	900	720	160	220	2,000
Admn. Overhead	900	720	160	220	2,000
Total Costs	₹8,100	6,480	1,440	1,980	18,000

Illustration 8: In a concern engaged in process industry four products emerge from a particular process of operation. The total cost of input for the period ended 30th September 2004 is ₹2,53,500. The details of output, additional cost after “split-off point” and sales value of the product are appended below:

<i>Products</i>	<i>Output</i>	<i>Additional processing cost after split-off point</i>	<i>Sales value</i>
	Kgs.	₹	₹
<i>A</i>	8,000	60,000	1,68,000
<i>B</i>	5,000	10,000	1,10,000
<i>C</i>	3,000	—	60,000
<i>D</i>	4,000	20,000	90,000

If the products are sold at “the split-off point” without further processing, the sales value would have been

	₹
<i>A</i>	1,15,000
<i>B</i>	90,000
<i>C</i>	55,000
<i>D</i>	80,000

You are required to prepare a statement of profitability based on the products being sold:

(i) After further processing (ii) At the split-off point.

Solution:

Statement Showing Profitability at the Split-off Point

<i>Products</i>	<i>Sales value at the split-off point (₹)</i>	<i>Joint costs apportioned (₹)</i>	<i>Profit (₹)</i>
A	1,15,000	85,743	29,257
B	90,000	67,103	22,897
C	55,000	41,007	13,993
D	80,000	59,647	20,353
Total	3,40,000	2,53,500	86,500

Note: Joint Cost is apportioned in the ratio of sales because joint cost has been incurred upto the split-off point.

$$A = 2,53,500 \times \frac{1,15,000}{3,40,000} = 85,743 \text{ and so on for } B, C \text{ and } D.$$

Statement Showing Profitability after Further Processing

<i>Product</i>	<i>Sales value after further processing (₹)</i>	<i>Additional processing cost (₹)</i>	<i>Net Sales value (₹)</i>	<i>Joint cost (₹)</i>	<i>Profit (₹)</i>
A	1,68,000	60,000	1,08,000	85,743	22,257
B	1,10,000	10,000	1,00,000	67,103	32,897
C	60,000	—	60,000	41,007	18,993
D	90,000	20,000	70,000	59,647	10,353
Total	4,28,000	90,000	3,38,000	2,53,500	84,500

<i>Product</i>	<i>Additional processing cost</i>	<i>Incremental Revenue (₹)</i>
A	60,000	1,68,000 – 1,15,000 = 53,000
B	10,000	1,10,000 – 90,000 = 20,000
C	—	60,000 – 55,000 = 5,000
D	20,000	90,000 – 80,000 = 10,000

Incremental revenue is greater than additional processing cost in case of B and C. These may be sold after further processing. A and D may be sold at the split-off point. Thus profit may be improved.

<i>Product</i>	<i>Profit (₹)</i>	
A	29,257	To be sold at split-off point
D	20,353	To be sold at split-off point
B	32,897	To be sold after additional processing
C	18,993	To be sold after additional processing
Total	1,01,500	Maximum profit

Illustration 9: In a chemical manufacturing company, three products *A*, *B* and *C* emerge at a single split off stage in department *P*. Product *A* is further processed in department *Q*, product *B* in department *R* and product *C* in department *S*. There is no loss in further processing of any of the three products. The cost data for a month are as under:

Cost of raw materials introduced in department <i>P</i>	₹12,68,800
Direct Wages in Departments	
<i>P</i>	₹3,84,000
<i>Q</i>	96,000
<i>R</i>	64,000
<i>S</i>	36,000

Factory overheads of ₹4,64,000 are to be apportioned to the departments on direct wages basis.

During the month under reference, the company sold all three products after processing them further as under:

Products	<i>A</i>	<i>B</i>	<i>C</i>
Output sold (kg.)	44,000	40,000	20,000
Selling Price per kg. (₹)	32	24	16

There are no Opening or Closing Stocks. If these products were sold at the split off stage, that is, without further processing, the selling prices would have been ₹20, ₹22 and ₹10 each per kg respectively for *A*, *B* and *C*.

Required :

- Prepare a statement showing the apportionment of joint costs to joint products.
- Present a statement showing product-wise and total profit for the month under reference as per the company's current processing policy.
- What processing decision should have been taken to improve the profitability of the company.
- Calculate the productwise and total profit arising from your recommendation in (iii) above.

Solution: (i) Statement Showing the Apportionment of Joint Costs.

Particulars	Products			Total
	<i>A</i>	<i>B</i>	<i>C</i>	
Output sold (kg.)	44,000	40,000	20,000	
S.P. per kg. at split-off stage (₹)	20	22	10	
Sales value at split-off stage (₹)	8,80,000	8,80,000	2,00,000	19,60,000
Joint costs incurred in Dept. <i>P</i> (₹)				
(Apportioned on sales value basis at the split-off point – Ratio 22 : 22 : 5)	8,80,000	8,80,000	2,00,000	19,60,000

Note: Total joint cost of Dept. *P* ₹19,60,000 (See Working Note)

(ii) Statement Showing Product-wise and Total Profit for the Month (Current Position)

Particulars	Products			Total
	<i>A</i>	<i>B</i>	<i>C</i>	
Output sold (kg.)	44,000	40,000	20,000	
S.P. per kg. after further processing (₹)	32	24	16	
(a) Sales value after further processing (₹)	14,08,000	9,60,000	3,20,000	26,88,000
Joint costs at split-off (₹)	8,80,000	8,80,000	2,00,000	19,60,000
Further process costs (See working note)	1,72,800	1,15,200	64,800	3,52,800
(b) Total Costs (₹)	10,52,800	9,95,200	2,64,800	23,12,800
Profit/Loss (a) – (b)	(₹) 3,55,200	(35,200)	55,200	3,75,200

(iii) Processing decision to improve the profitability of the company

Products *A* and *C* should be sold after further processing as both the products are yielding profit after further processing. However, product *B*, should be sold at split-off point as further processing cost of this product is more than its sales value and it is yielding loss.

(iv) Product-wise and total profit arising from the recommendation at (iii) above

Profit after further processing:

Product A	₹3,55,200
Product C	55,200
Total profit after further processing	4,10,400

Working Note:

Statement Showing Department-wise Costs

Particulars	Departments			
	P	Q	R	S
Raw materials (₹)	12,68,800			
Wages (given) (₹)	3,84,000	96,000	64,000	36,000
Overheads apportioned (₹) (96 : 24 : 16 : 9)	3,07,200	76,800	51,200	28,800
Total costs	19,60,000	1,72,800	1,15,200	64,800

It is noted from the above statement that costs incurred in Dept. *P* are the joint costs at split-off of products *A*, *B* and *C*. The joint costs at split-off point are ₹19,60,000. However, costs incurred in Dept. *Q*, *R* and *S* are further processing costs of products *A*, *B* and *C*. Further processing costs of products *A*, *B* and *C* are ₹1,72,800, ₹1,15,200 and ₹64,800 respectively.

Illustration 10: Tee Pee Ltd. in the course of refining crude oil obtains four joint products. *A*, *B*, *C* and *D*. The total cost till the split-off point was ₹97,600. The output and sales in the year 2004, were as follows:

Product	Output (Gallons)	Sales (₹)	Separate costs (₹)
A	5,00,000	1,15,000	30,000
B	10,000	10,000	6,000
C	5,000	4,000	—
D	9,000	30,000	1,000

You are required to:

- Calculate the net income for each of the products if the joint costs are apportioned on the basis of sales value of the different products.
- What would be the net income of the company from each product if it decides to sell the products at the split-off point itself @ *A* 15 paise; *B* 50 paise; *C* 80 paise and *D* ₹3 per gallon?
- In case the company expects to operate at the same level of production and sales in the year 2005, could the company increase the net income by altering its processing decisions? If so, what would be the expected overall net income? Which products should be processed further and which should be sold at split-off? Assume that all costs incurred after the split-off are variable.

Solution: (i) Statement of Net Income for Each of the Products

Product	Sales Value ₹	Joint Cost ₹	Separate Cost ₹	Total Cost ₹	Sales Value ₹	Profit ₹
A	1,15,000	70,592	30,000	1,00,592	1,15,000	14,408
B	10,000	6,138	6,000	12,138	10,000	(–)2,138
C	4,000	2,455	—	2,455	4,000	1,545
D	30,000	18,415	1,000	19,415	30,000	10,585
Total	1,59,000	97,600	37,000	1,34,600	1,59,000	24400

Note: 1 Joint cost has been apportioned to product on the basis of Sales Values

i.e. $\frac{97,600 \times 1,15,000}{1,59,000} = 70,592$ will be of A. For B, C & D, similar calculations may be made.

(ii) Statement of the Net Income

Product	Sales Value at Split-off Point ₹	Joint Cost ₹	Profit ₹
A	$5,00,000 \times 0.15 = 75,000$	70,592	4,408
B	$10,000 \times 0.50 = 5,000$	6,138	(-) 1,138
C	$5000 \times 0.80 = 4,000$	2,455	1,545
D	$9,000 \times 3.00 = 27,000$	18,415	8,585
Total	1,11,000	97,600	13,400

In case of A and D there is incremental gain after further processing.

	A	D
Incremental Sales Value	40,000	3,000
Separate Costs	30,000	1,000
Incremental gains	10,000	2000

Hence A & D should be processed further.

Note: Incremental Sales Value Product A ₹115000 – 75000 = 40,000 and Product D 30,000 – 27,000 = 3,000.

Statement Showing Overall Income

Product	Sales value	Joint Cost	Separate Cost	Total Cost	Profit
A	1,15,000	70,592	30,000	1,00,592	14,408
B	5,000	6,138	—	6,138	(-) 1,138
C	4,000	2,455	—	2,455	1,545
D	30,000	18,415	1,000	19,415	10,585
Total	1,54,000	97,600	31,000	1,28,600	25,400

By altering the processing decisions, the overall net income would be ₹25,400.

Illustration 11: Three joint products are produced by passing chemicals through two processes. Output from process 1 is transferred to process 2 from which the three joint products are produced and immediately sold. The data regarding the processes for April, 2000 is given below:

	Process 1	Process 2
Direct Material 2500 kgs at ₹4 per kg	₹10,000	—
Direct Labour	₹6,250	₹6,900
Overheads	₹4,500	₹6,900
Normal loss	10% of input	Nil
Scrap value of loss	₹2 per kgs	—
Output	2300 kilo	Joint products A — 900 kgs B — 800 kgs C — 600 kgs

There were no opening or closing stocks in either process and the selling prices of the output from Process 2 were:

Joint Product A	₹24 per kg
Joint Product B	₹18 per kg
Joint Product C	₹12 per kg

Required:

(a) Prepare an account for Process 1 together with any Loss or Gain Account you consider necessary to record the month's activities.

(b) Calculate the profit attributable to each of the joint products by apportioning the total costs from Process 2: (i) According to weight of output. (ii) By the market value of production.

Solution:

Process 1 Account

	Kg.	Rate	Amt. (₹)		Kg	Rate	Amt. (₹)
To Direct Material	2500	4	10,000	By Normal Loss			
To Direct Labour			6250	(10% of 2,500)	250	2	500
To Overheads			4,500	By Output to			
				Process 2	2,300	9	20,700
	2500		20750				
To Abnormal Gain	50	9	450				
	2,550		21,200		2,550		21,200

$$\text{Cost per unit} = \frac{\text{Total cost} - \text{Value of normal scrap}}{\text{Input} - \text{Normal loss}} = \frac{20,750 - 500}{2,500 - 250}$$

$$= \frac{20,250}{2,250} = ₹9 \text{ per unit}$$

Abnormal Gain Account

	Kg.	Rate	Amt. (₹)		Kg	Rate	Amt. (₹)
To Normal Loss	50	2	100	By Process I.	50	9	450
To Costing P & L			350				
	50		450		50		450

Normal Loss Account

	Kg.	Rate	Amt. (₹)		Kg	Rate	Amt. (₹)
To Process I	250	2	500	By Debtors/Cash			
				(Sale of actual			
				scrap)	200	2	400
				By Abnormal Gain	50	2	100
	250		500		250		500

(b) Joint Cost of Products

		₹
Cost of output from Process I (2300 Kg. @ ₹9)		20,700
Direct Labour in Process 2.		6,900
Overheads in Process 2.		6,900
Joint Costs of Products		34,500
Output – Joint Products (Kg.)		
A	900	
B	800	
C	600	
	<u>2300</u>	

(i) Apportionment of Joint Costs According to Weight and Calculation of Profit

Joint	Output Kg.	Apportionment Joint Cost (₹)	Sales Value (₹)	Profit or (loss) ₹
A	900	13,500	900 × 24 = 21,600	8,100
B	800	12,000	800 × 18 = 14,400	2,400
C	600	9,000	600 × 12 = 7,200	(-) 1,800
Total	2300	34,500	43,200	8,700

Calculations:

$$A = \frac{900 \times 34,500}{2,300} = 13,500$$

$$B = \frac{800 \times 34,500}{2,300} = 12,000$$

$$C = \frac{600 \times 34,500}{2,300} = 9,000$$

(ii) Apportionment of Joint Costs by Marked Value and Calculation of Profit

Joint Product	Sales Value (₹)	Apportionment Joint Costs (₹)	Profit (₹)
A	21,600	17,250	4,350
B	14,400	11,500	2,900
C	7,200	5,750	1,450
Total	43,200	34,500	8,700

Calculations:

$$A = \frac{21,600 \times 34,500}{43,200} = ₹17,250$$

$$B = \frac{14,400 \times 34,500}{43,200} = ₹11,500$$

$$C = \frac{7,200 \times 34,500}{43,200} = ₹5,750$$

Illustration 12: A company's plant processes 1,50,000 kgs of raw material in a month to produce two products, viz. 'P' and 'Q'. The cost of raw material is ₹12 per kg. The process costs per month are:

	₹
Direct Materials	90,000
Direct Wages	1,20,000
Variable Overheads	1,00,000
Fixed Overheads	1,00,000

The loss in process is 5% of input and the output ratio of P and Q which emerge simultaneously is 1 : 2. The selling prices of the two products at the point of split off are : P ₹12 per kg. and Q ₹20 per kg. A proposal is available to process P further by mixing it with other purchased materials. The entire current output of the plant can be so processed further to obtain a new product 'S'. The price per kg of S is ₹15 and each kg. of output of S will require one kilogram of input P. The cost of processing of P into S (including other materials) is ₹1,85,000 per month.

You are required to prepare a statement showing the monthly profitability based both on the existing manufacturing operations and on further processing.

Will you recommend further processing?

Solution:**Working notes:**1. *Input*

Less: Loss in process 5%

Total output

 $P = 1/3$ of 1,42,500 $Q = 2/3$ of 1,42,5002. *Joint costs:*Raw materials $1,50,000 \times 12$

Direct Materials

Direct wages

Variable overheads

Fixed overheads

3. *Sales:* $P = 47,500 \times 12$ $Q = 95,000 \times 20$

Total

Ratio of sales = 57 : 190 i.e. 3 : 10

4. *Joint Cost in Sales Ratio* $P = 22,10,000 \times 3/13 = ₹5,10,000$ $Q = 22,10,000 \times 10/13 = ₹17,00,000$ **Statement Showing the Monthly Profitability**

	Based on existing manufacturing operation products			Based on further processing of P into S Product		
	P	Q	Total	S	Q	Total
Sales quantity (kg.)	47,500	95,000	1,42,500	47,500	95,000	1,42,500
	₹	₹	₹	₹	₹	₹
Sales Revenue	5,70,000	19,00,000	24,70,000	7,12,500	19,00,000	26,12,500
Less: Joint Costs	5,10,000	17,00,000	22,10,000	6,95,000	17,00,000	23,95,000
Profit	60,000	2,00,000	2,60,000	17,500	2,00,000	2,17,500

 $5,10,000 + 1,85,000$ further processing = ₹6,95,000

Recommendation : Further processing of P is not recommended as it results in a lower profit of P by ₹42,500:

Additional Sales Revenue $47,500 \times 3 =$ 1,42,500

Further Processing

1,85,000

Loss on processing of P into S =

(–) 42,500

Illustration 13: Bright Chemicals Ltd. electrolyses common salt to obtain 3 joint products Caustic Soda, Chlorine and Hydrogen. During a costing period, the expenditure relating to the inputs for the common process amounted to ₹3,50,000. After separation, expenses amounting to ₹1,60,000, ₹75,000 and ₹10,000 were incurred for caustic soda, chlorine and hydrogen respectively. The entire production was sold and ₹3,75,000, ₹2,50,000 and ₹60,000 were realised for caustic soda, chlorine and hydrogen respectively. The selling expenses were estimated at 5% of realisations from sale. The management expected profits at 15%, 10% and 5% of realisations from sale of caustic soda, chlorine and hydrogen respectively.

Draw a columnar statement showing the apportionment of Joint. Costs and the profitability of each product.

**Statement Showing the Apportionment of Joint Costs
and the Profitability of Each Product (₹)**

Particulars	Caustic Soda	Chlorine	Hydrogen	Total
	₹	₹	₹	₹
Sales Realisation	3,75,000	2,50,000	60,000	6,85,000
Less : Expected Profit (15%, 10% and 5%)	– 56,250	– 25,000	– 3,000	– 84,250
Less : Selling Expenses at 5% on sales	– 18,750	– 12,500	– 3,000	– 34,250
Estimated Cost of Production	3,00,000	2,12,500	54,000	5,66,500
Less : After Separation Exp.	– 1,60,000	– 75,000	– 10,000	– 2,45,000
Estimated Joint Costs	1,40,000	1,37,500	44,000	3,21,500
Percentage of Joint Costs	43.546%	42.768%	13.686%	100%
Apportionment of Joint Costs of 3,50,000 on the basis of above percentage	1,52,411	1,49,688	47,901	3,50,000
Add : After Separation Exp.	1,60,000	75,000	10,000	2,45,000
Actual Cost of Production	3,12,411	2,24,688	57,901	5,95,000
Add: Selling expenses at @ 5% on sales	18,750	12,500	3,000	34,250
Total Cost	3,31,161	2,37,188	60,901	6,29,250
Sales	3,75,000	2,50,000	60,000	6,85,000
Profit (Loss)	43,839	12,812	(901)	55,750

Illustration 14: In a manufacturing Company 10,000 kilolitres of 'A' is processed to produce 6,000 kilolitres of 'B' and 4,000 kilolitres of 'C'. The joint cost before separation point came to an amount of ₹24,000. From the following particulars, calculate the apportionment of joint cost and the profit of each product under (a) physical measurement, (b) market value at separation point, and (c) market value after further processing.

	B	C
	₹	₹
Unit selling price at separation point	5.00	3.75
Unit selling price after further processing	7.00	7.50
Further processing costs after separation	5,000	7,500

Solution:

(a) Apportionment of Joint Cost and Profit under Physical Measurement

Total quantity A 10,000 kl is processed to produce B 6,000 kl & C 4000 kl.

Ratio of A in B & C = 3 : 2

	B	C	Total
	₹	₹	₹
Allocation of Joint Cost of ₹24,000 in the ratio of 3 : 2	14,400	9,600	24,000
Selling price @ ₹5.00 × 6,000 =	30,000		30,000
@ ₹3.75 × 4000 =		15,000	15,000
Profit	15,600	5,400	21,000

(b) Apportionment of Joint Cost and Profit Under Market Value at Separation Point

	<i>B</i> ₹	<i>C</i> ₹	<i>Total</i> ₹
Market value @ ₹5.00 × 6,000	30,000		30,000
@ 3.75 × 4,000		15,000	15,000
Allocation of joint cost of ₹24,000	30,000	15,000	45,000
in the ratio of sales i.e. 30:15	16,000	8,000	24,000
Profit	14,000	7,000	21,000

**(c) Apportionment of Joint Cost and Profit Under
Market Value after Further Processing**

	<i>B</i> ₹	<i>C</i> ₹	<i>Total</i> ₹
Market value @ 7.00 × 6,000	42,000		42,000
@ 7.50 × 4,000		30,000	30,000
	42,000	30,000	72,000
Allocation of joint cost of ₹24,000 in ratio market value	14,000	10,000	24,000
Add: Further processing cost	5,000	7,500	12,500
Total cost	19,000	17,500	36,500
Profit	23,000	12,500	35,500

Illustration 15: ABC Ltd. operates a simple chemical process to convert a single material into three separate items, referred to here as X, Y and Z. All the three end-products are separated simultaneously at a single split-point.

Products X and Y are ready for sale immediately upon split off without further processing or any other additional costs. Product Z, however, is processed further before being sold. There is no available market price for Z at the split-off point.

The selling prices quoted here are expected to remain the same in the coming year. During 2002-03, the selling prices of the items and the total amounts sold were.

X – 186 tons sold for ₹1,500 per ton

Y – 527 tons sold for ₹1,125 per ton

Z – 736 tons sold for ₹750 per ton

The total joint manufacturing costs for the year were ₹6,25,000. An additional ₹3,10,000 was spent to finish product Z.

There were no opening inventories of X, Y or Z. At the end of the year, the following inventories of complete units were on hand:

X 180 tons; Y 60 tons; Z 25 tons;

There was no opening or closing work-in-progress.

Required:

(i) Compute the cost of inventories of X, Y and Z for Balance Sheet purposes and cost of goods sold for income statement purpose as on March 31, 2003, using:

(a) Net realizable value (NRV) method of joint cost allocation.

(b) Constant gross-margin percentage NRV method of joint-cost allocation.

(ii) Compare the gross-margin percentages for X, Y and Z using two methods given in requirement (i).

Solution:**(i) (a) Statement of Joint Cost Allocation of Inventories of X, Y and Z for Balance Sheet Purpose (By Using Net Realizable Value Method)**

	<i>Products</i>			<i>Total</i> ₹
	<i>X</i> ₹	<i>Y</i> ₹	<i>Z</i> ₹	
Final sales value of total production	5,49,000	6,60,375	5,70,750	17,80,125
Less: Additional cost	—	—	3,10,000	3,10,000
Net realizable value at split off	5,49,000	6,60,375	2,60,750	14,70,152
Joint cost allocated in proportion of NRV at split-off	2,33,398	2,80,748	1,10,854	6,25,000

**Cost of Goods Sold for Income Statement Purposes as on March 31, 2003
(By Using Net Realizable Value Method)**

	<i>Products</i>			<i>Total</i> ₹
	<i>X</i> ₹	<i>Y</i> ₹	<i>Z</i> ₹	
Allocated Joint Cost	2,33,398	2,80,748	1,10,854	6,25,000
Additional Cost	—	—	3,10,000	3,10,000
	2,33,398	2,80,748	4,20,854	9,35,000
Less: Cost of year end inventory (Note 1 X 49.18%; Y 10.22%; Z 3.29%)	1,14,785	28,692	13,846	1,57,323
Cost of Goods sold	1,18,613	2,52,056	4,07,008	7,77,677

**Income Statement
(Showing Gross Margin and Gross Margin Percentage)
(By Using Net Realizable Value Method)**

	<i>Products</i>			<i>Total</i> ₹
	<i>X</i> ₹	<i>Y</i> ₹	<i>Z</i> ₹	
Sales Revenue	2,79,000	5,92,875	5,52,000	14,23,875
Less: Cost of Goods Sold	1,18,613	2,52,056	4,07,008	7,77,697
Gross Margin	1,60,387	3,40,819	1,44,992	6,46,178
Gross Margin %	57.49%	57.49%	26.27%	

**(b) Statement of Joint Cost Allocation of Inventories of X, Y and Z for Balance Sheet Purpose
(By Using Constant Gross Margin Percentage NRV Method)**

	<i>Products</i>			<i>Total</i> ₹
	<i>X</i> ₹	<i>Y</i> ₹	<i>Z</i> ₹	
Final sales value of total production	5,49,000	6,60,375	5,70,750	17,80,125
Less: Gross Margin (Note 2) 47.4756%	2,60,641	3,13,517	2,70,967	8,45,125
	2,88,359	3,46,858	2,99,783	9,35,000
Less: Additional Cost	—	—	3,10,000	3,10,000
Joint Cost Allocated	2,88,359	3,46,858	(10,217)	6,25,000

Note. The negative joint cost allocation to product Z is peculiar feature of Constant Gross Margin NRV Method.

Cost of Goods Sold for Income Statement Purposes
(By Using Constant Gross Margin Percentage NRV Method)

	<i>Products</i>			<i>Total</i> ₹
	<i>X</i> ₹	<i>Y</i> ₹	<i>Z</i> ₹	
Allocated Joint Cost	2,88,359	3,46,858	(10,217)	6,25,000
Additional Cost	—	—	3,10,000	3,10,000
Cost Goods available for sale	2,88,359	3,46,858	2,99,783	9,35,000
Less: Cost of year-end inventory (Note I) X 49.18%; Y 10.22%; Z 3.29%	1,41,815	35,449	9,863	1,87,127
Cost of Goods Sold	1,46,544	3,11,409	2,89,920	7,47,873

Income Statement
(Showing Gross Margin and Gross Percentage by Using
Constant Gross Margin Percentage NRV Method)

	<i>Products</i>			<i>Total</i> ₹
	<i>X</i> ₹	<i>Y</i> ₹	<i>Z</i> ₹	
Sales Revenue (₹)	2,79,000	5,92,875	5,52,000	14,23,875
Less: Cost of Goods Sold	1,46,544	3,11,409	2,89,920	7,47,873
Gross Margin	1,32,456	2,81,466	2,62,080	6,76,002
Gross Margin %	47.475%	47.475%	47.478%	47.476%

(ii) Comparative Statement of Gross Margin Percentage for X, Y and Z
(Using Net Realizable Value and Constant Gross Margin Percentage NRV Methods)

	<i>Products Gross Margin Percentages</i>		
	<i>X</i>	<i>Y</i>	<i>Z</i>
Net Realizable Value Method	57.49%	57.49%	26.27%
Constant Gross Margin NRV Method	47.48%	47.48%	47.48%

Working Notes:

1. Total production of three products for the year 2002-03.

<i>Items/ Products</i>	<i>Quantity sold in tons</i>	<i>Quantity of year-end inventory in tons</i>	<i>Total Production</i>	<i>Percentage by year-end inventory to total production (5) = (3)/(4) × 100</i>
(1)	(2)	(3)	(4) = (2) + (3)	(5)
X	186	180	366	49.18
Y	527	60	587	10.22
Z	736	25	761	3.29

2. Gross Margin Percentage:

Final Sales Value of Total Production	₹17,80,125
Less: Joint Cost and Additional Cost (₹6,25,000 + ₹3,10,000)	9,35,000
Gross Margin	8,45,125
Gross Margin Percentage (8,45,125/17,80,125) × 100 =	47.4756%.

Illustration 16: If the products are truly joint products, the cost of the process can be applied to these products:

- (i) On the basis of weight or other physical quantity of each product;
- (ii) In respect of marginal cost of the process on the basis of physical quantities of various products and in respect of fixed costs of the process on the basis of contributions made by various products;
- (iii) On the basis of sale values of the different products.

Illustrate the above statement by using the following figures in respect of joint production of A and B for a month:

	₹
Direct Materials	5,000
Direct Labour	3,000
Variable Overheads	2,000
Fixed Overheads	2,000
Sales	

A—100 quintals @ ₹80 per quintal

B—150 quintals @ ₹40 per quintal

- (iv) Also compute the profit/loss per product under each of these methods.

Solution:

Working Notes:

	₹
1. Sales	
A: 100 quintals @ ₹80	8,000
B: 150 quintals @ ₹40	6,000
Total Sales Value	14,000
Marginal cost (5,000 + 3,000 + 2,000)	10,000
Contribution	4,000
Less : Fixed Overheads	2,000
Profit	2,000

Joint costs of A & B = Marginal Cost + Fixed Overheads
= 10,000 + 2,000 = 12,000

Apportionment of Joint Costs:

- (i) On the basis of weight i.e. 100 : 150 quintals.

A : $12,000 \times \frac{100}{250}$	4,800
B : $12,000 \times \frac{150}{250}$	7,200
	12,000

- (ii) Marginal cost on the basis of weight and fixed cost on the basis of contribution:

A : Marginal Cost $\left(10,000 \times \frac{100}{250}\right)$	4,000
Fixed Cost	2,000
	6,000
B: Marginal Cost $\left(10,000 \times \frac{150}{250}\right)$	6,000
Fixed Costs	nil
	6,000

Note :	Total	A	B
Sales Value	14,000	8,000	6,000
Marginal Cost	10,000	4,000	6,000
Contribution	4,000	4,000	nil

(iii) On the basis of Sales Values:

$$A : 12,000 \times \frac{8,000}{14,000} = 6,857$$

$$B : 12,000 \times \frac{6,000}{14,000} = 5,143$$

12,000

(iv) Statement of Profits Under Each of These Methods (₹)

Method	i		ii		iii	
Product	A	B	A	B	A	B
Sales Value	8,000	6,000	8,000	6,000	8,000	6,000
Total Cost	4,800	7,200	6,000	6,000	6,857	5,143
Profit	3,200	(-) 1,200	2,000	—	1,143	857
Total Profit of A + B	2,000		2,000		2,000	

Illustration 17: Pokemon Chocolates manufactures and distributes chocolate products. It purchases Cocoa beans and processes them into two intermediate products:

- Chocolate powder liquor base
- Milk-chocolate liquor base.

These two intermediate products become separately identifiable at a single split off point. Every 500 pounds of cocoa beans yields 20 gallons of chocolate-powder liquor base and 30 gallons of milk-chocolate liquor base.

The chocolate powder liquor base is further processed into chocolate powder. Every 20 gallons of chocolate-powder liquor base yields 200 pounds of chocolate powder. The milk-chocolate liquor base is further processed into milk-chocolate. Every 30 gallons of milk-chocolate liquor base yields 340 pounds of milk chocolate.

Production and sales data for October, 2004 are :

• Cocoa beans processed	7,500 pounds
• Costs of processing Cocoa beans to split off point (including purchase of beans)	₹7,12,500
	Production Sales Selling Price
Chocolate Powder	3,000 3,000 ₹190
	pounds pounds per pound
Milk Chocolate	5,100 5,100 ₹237.50
	pounds pounds per pounds

The October, 2004 separable costs of processing chocolate-powder liquor into chocolate powder are ₹3,02,812.50. The October, 2004 separable costs of processing milk-chocolate liquor base into milk-chocolate are ₹6,23,437.50.

Pokemon fully processes both of its intermediate products into chocolate powder or milk-chocolate. There is an active market for these intermediate products. In October, 2004, Pokemon could have sold the chocolate powder liquor base for ₹997.50 a gallon and the milk-chocolate liquor base for ₹1,235 a gallon.

Required :

- (i) Calculate how the joint cost of ₹7,12,500 would be allocated between the chocolate powder and milk-chocolate liquor bases under the following methods:
 - (a) Sales value at split off point
 - (b) Physical measure (gallons)
 - (c) Estimated net realisable value, (NRV) and
 - (d) Constant gross-margin percentage NRV.
- (ii) What is the gross-margin percentage of the chocolate powder and milk-chocolate liquor bases under each of the methods in requirement (i) ?
- (iii) Could Pokemon have increased its operating income by a change in its decision to fully process both of its intermediate products ? Show your computations.

1. Comparison of Alternative Joint Allocation Methods

(a) Joint cost allocation on the bases of sales value of split-off point

Sales value of chocolate powder liquor base

$$3000 \text{ Pounds} = 3000 \times \frac{20}{200} = 300 \text{ gallons}$$

Sales value of 300 gallons @ ₹997.5 = ₹2,99,250

Sales value of milk chocolate liquor base

$$5100 \text{ pounds} = 5100 \times \frac{30}{340} = 450 \text{ gallons}$$

Sales value of 450 gallons @ ₹1235 = ₹5,55,750

Ratio of Sales Value 2,99,250 : 5,55,750 = 35 : 65

Joint Cost Allocation (₹)

$$\text{Chocolate powder } 7,12,500 \times \frac{35}{100} = ₹2,49,375$$

$$\text{Milk chocolate } 7,12,500 \times \frac{65}{100} = ₹4,63,125$$

(b) Physical Measure Method (gallons)

Chocolate powder : 300 gallons

Milk chocolate 450 gallons

Ratio of gallons = 300/750 : 450/750

2 : 3

Joint Cost Allocation

$$\text{Chocolate powder : } 7,12,500 \times \frac{2}{5} = ₹2,85,000$$

$$\text{Milk chocolate : } 7,12,500 \times \frac{3}{5} = ₹4,27,500$$

(c) Net Realisable Value Method

	Chocolate powder	Milk chocolate
Final Sales	3000 × 190 5,70,000.00	5100 × 237.5 12,11,250.00
Deduct Separable Cost	3,02,812.50	6,23,437.50
Net realisable value at split off	2,67,187.50	5,87,812.50
Ratio	0.3125	0.6875
Joint cost allocation	7,12,500 × .3125	7,12,500 × .6875
On the bases of above ratio	= 2,22,656.25	= 4,89,843.75

(d) Constant Gross Margin Percentage Method

Final sale value of total production (5,70,000 + 12,11,250)	₹17,81,250
Deduct total joint and separate cost (7,12,500 + 9,26,250)	16,38,750
Gross Margin	1,42,500
Gross Margin Percentage (1,42,500/17,81,500) × 100 = 8%	

	<i>Chocolate powder liquor base (₹)</i>	<i>Milk chocolate liquor base (₹)</i>	<i>Total (₹)</i>
Final sales value	57,000	12,11,250	17,81,250
Less Gross margin @ 8%	45,600	96,900	1,42,500
Cost of goods available for sale	5,24,400	11,14,350	16,38,750
Deduct separable cost	3,02,812.50	6,23,437.50	9,26,250
Joint Cost Allocated	2,21,587.5	4,90,912.50	7,12,500

(ii) Gross Margin Percentages

	<i>Chocolate powder liquor base (₹)</i>	<i>Milk chocolate liquor base (₹)</i>	<i>Total (₹)</i>
Sales value at split off point	3.125%	10.294%	8%
Physical measure method	(3.125%)	13.235%	8%
NRV method	7.812%	8.088%	8%
Constant gross margin % NRV method	8%	8%	8%

1. (iii) Further processing of chocolate powder liquor base into chocolate powder-

Incremental revenue-₹5,70,000-(997.5 × 300)	= ₹2,70,750.00
Incremental Cost	302812.50
Incremental Operating Income	(32112.50)

Since incremental operating income is negative after further processing it should not be processed further but sold only at split off point

Further processing of Milk chocolate liquor base into milk chocolate

Incremental revenue ₹1211250-₹555750	= ₹6,55,500.00
Incremental Cost	6,23,437.50
Incremental Operating Income	3,20,62.50

Pokemon chocolates could increase operating income by ₹32,062.50 if chocolate liquor base is sold at split off point and milk chocolate liquor base is further processed into milk chocolate.

Illustration 18: Sellwell Ltd. operates a chemical process which produces four products A, B, C and D from a basic raw material. The company's budget for a month is as under:

	₹
Raw materials consumption	17,520
Initial processing wages	16,240
Initial processing overheads	16,240

Product	Production	Sales	Additional Processing cost after split-off
	(Kgs.)	(₹)	(₹)
A	16,000	1,09,600	28,800
B	200	5,600	—
C	2,000	30,000	16,000
D	360	21,600	6,600

The company presently intends to sell products *B* at the point of split-off without further processing. The remaining products *A*, *C* and *D* are to be further processed and sold. However, the management has been advised that it would be possible to sell all the four products at the split-off point without further processing and if this course was adopted, the selling prices would be as under:

Product	A	B	C	D
Selling Price per kg. (₹)	4.00	28.00	8.00	40.00

The joint costs are to be apportioned on the basis of the sales value realisation at the point of split-off.

You are required to :

- Prepare a statement showing the apportionment of joint costs.
- Prepare a statement showing the productwise and total budgeted profit or loss based on the proposal to sell product *B* at the split-off point and products *A*, *C* and *D* after further processing.
- Prepare a statement to show the productwise and total profit or loss if the alternative strategy to sell all the products at split-off stage was adopted.
- Recommend any other alternative which, in your opinion, can increase the total profit further. Calculate the total profit as also the productwise profit or loss, based on your recommendation.

Solution:

(a) Statement Showing the Apportionment of Joint Costs

Total Joint Costs 17,520 + 16,240 + 16,240 = ₹50,000

Product	Sales Value at split-off point	Joint Costs Apportioned in the ratio of sales
A	$16,000 \times 4 = 64,000$	32,000
B	$200 \times 28 = 5,600$	2,800
C	$2,000 \times 8 = 16,000$	8,000
D	$360 \times 40 = 14,400$	7,200
Total	₹1,00,000	₹50,000

(b) Statement Showing Budgeted Profit or Loss (₹)

Product	Joint cost ₹	Additional Processing cost	Total cost ₹	Sales value ₹	Profit ₹
A	32,000	28,800	60,800	1,09,600	48,800
B	2,800	—	2,800	5,600	2,800
C	8,000	16,000	24,000	30,000	6,000
D	7,200	6,600	13,800	21,600	7,800
Total	50,000	51,400	1,01,400	1,66,800	65,400

(c) Statement of Profit or Loss at Split-off Point (₹)

<i>Product</i>	<i>Joint Cost</i>	<i>Sales Value</i>	<i>Profit</i>
<i>A</i>	32,000	64,000	32,000
<i>B</i>	2,800	5,600	2,800
<i>C</i>	8,000	16,000	8,000
<i>D</i>	7,200	14,400	7,200
Total	50,000	1,00,000	50,000

(d) Product *B* requires no further processing. In case of Product *C*, if further processed, the incremental sales value will be ₹14,000 i.e. ₹30,000 – 16,000. Thus *C* should not be processed. In case of Product *A* and *D*, the position will be as below.

	<i>A</i>	<i>D</i>
Incremental Sales Value	45,600	7,200
Additional Processing Costs	28,800	6,600
Incremental Gain	<u>16,800</u>	<u>600</u>

Hence, *A* & *D* should be processed further, *B* & *C* should be sold at split-off point.

Statement Showing Profit

<i>Product</i>	<i>Sales Value</i>	<i>Total Cost</i>	<i>Profit</i>
<i>A</i>	1,09,600	60,800	48,800
<i>B</i>	5,600	2,800	2,800
<i>C</i>	16,000	8,000	8,000
<i>D</i>	21,600	13,800	7,800
Total	1,52,800	85,400	67,400

Illustration 19: JKL Limited produces two products – *J* and *K* together with a by-product *L* from a single main process (Process *I*). Product *J* is sold at the point of separation for ₹55 per kg, whereas product *K* is sold for ₹77 per kg, after further processing into product *K2*. By-product *L* is sold without further processing for ₹19.25 per kg.

Process *I* is closely monitored by a team of chemists, who planned the output per 1,000 kg of input materials to be as follows:

Product <i>J</i>	500 kg
Product <i>K</i>	350 kg
Product <i>L</i>	100 kg
Toxic waste	50 kg

The toxic waste is disposed at a cost of ₹16.50 per kg, and arises at the end of processing.

Process *II* which is used for further processing of product *K* into product *K2*, has the following cost structure:

Fixed costs	₹2,64,000 per week
Variable cost	₹16.50 per kg processed

The following actual data relate to the first week of the month:

Process *I*

Opening Work-in-Progress	Nil
Material input 40,000 kg costing	₹6,60,000
Direct labour	₹4,40,000
Variable Overheads	₹1,76,000
Fixed Overheads	₹2,64,000

Output:

Product J	19,200 kg
Product K	14,400 kg
Product L	4,000 kg
Toxic waste	2,400 kg
Closing Work-in-Progress	Nil

Process II

Opening Work-in-Progress	Nil
Input of product K	14,400 kg
Output of product K2	13,200 kg
Closing Work-in-Progress (50% converted and conversion Costs were incurred in accordance with the planned Cost structure)	1,200 kg

Required:

- Prepare Process I account for the first week of the month using the final sales value method of attribute the pre-separation costs to joint products.
- Prepare the Toxic Waste Account and Process II account for the first week of the month.
- Comment on the method used by the JKL Limited to attribute the pre-separation costs to joint products.
- Advise the management of JKL Limited whether or not, on purely financial grounds, it should continue to process product K into product K2:
 - If product K could be sold at the point of separation for ₹47.30 per kg; and
 - If the 60% of the weekly fixed costs of Process II were avoided by not processing product K further.

Solution:**Process I Account**

Particulars	Qty in kg	Rate per kg ₹	Amount ₹	Particulars	Qty in kg	Rate per kg ₹	Amount ₹
To Material input	40,000	16.50	6,60,000	By Product L sales	4,000	19.25	77,000
To Direct labour			4,40,000	By Toxic waste (Normal loss)	2,000	16.50	-33,000*
To Variable Overheads			1,76,000	By Abnormal loss	400	44	17,600
To Fixed Overheads			2,64,000	By Joint Product J (Refer to Working Note 2)	19,200		7,21,171
				By Joint product K (Refer to Working Note 2)	14,400		7,57,229
	40,000		15,40,000		40,000		15,40,000

$$\text{Valuation of abnormal loss per kg} = \frac{\text{₹. 15,40,000} - \text{₹. 77,000} + \text{₹. 33,000}}{40,000 \text{ Kgs.} \times 0.85}$$

(Using physical measure method)

$$= \text{₹}14,96,000/34,000 \text{ kgs.}$$

$$= \text{₹}44 \text{ per kg.}$$

***Note.** Toxic Waste is not sold. It is disposed off by increasing expenses @ ₹16.50 per kg. The amount is shown as minus figure in the credit side (may be debited).

(ii) Toxic Waste Account (Normal Loss)

Particulars	Qty in kg	Rate /kg ₹	Amount ₹	Particulars	Qty in kg	Rate/ kg ₹	Amount ₹
To Process I A/c	2,000	16.50	(-)33,000	By Balance		16.50	(-)33,000

Process II Account

Particulars	Qty in kg	Rate /kg ₹	Amount ₹	Particulars	Qty in kg	Rate/ kg ₹	Amount ₹
To Process I A/c (Product K)	14,400	52.585	7,57,236	By Product K2 account	13,200		11,73,924
To Variable Overheads		16.50	2,37,600	By Closing WIP (Refer to Working Note 3)	1,200		84,912
To Fixed Overheads			2,64,000				
			12,58,836				12,58,836

Working notes:

1. Calculation of joint cost of the output:

$$= ₹15,40,000 - ₹77,000 - ₹(-) 33,000 - ₹17,600$$

$$= ₹14,78,400$$

2. Allocation of joint cost over joint products J & K

(By using final sales value method)

Products	Quantity (Kgs)	Sales value ₹	Joint cost ₹
J	19,200	10,56,000 (19,200 kgs × ₹55)	7,21,171
K	14,400	11,08,800 (14,400 kgs × ₹77)	7,57,229
Total		21,64,800	14,78,400

3. Valuation of 1200 Kgs. of Closing WIP :

Material I	100% complete	₹
	(1200 kgs × ₹52.5858)	63,103
Fixed & variable overheads	$\left(\frac{₹. 5,01,600}{13,800 \text{ units}} \right) \times 600 \text{ units}$	21,809
Total valuation of 1,200 kgs of closing WIP		<u>84,912</u>

(iii) Comment on the method used by the JKL Ltd :

(To attribute the pre-separation costs to joint products)

For attributing the joint costs over joint products J and K, JKL Ltd., used the basis of final sales value. This is one of the popular method used in the industry.

Other methods can also be used for the purpose.

(i) Physical Measure Method (if both the products are equally complex).

(ii) Constant Gross Margin Percentage Method.

(iii) Net Realizable Value Method.

(iv) Advice to the Management of JKL Ltd.:

	₹
Incremental sales revenue per kg. from further processing	29.70
Less: Incremental variable cost per kg. of further processing	16.50
Incremental contribution per kg from further processing	13.20
At an output of 14,400 kgs the incremental contribution will be:	1,90,080
Less: Avoidable fixed cost	
(60% × ₹2,64,000)	1,58,400
Net benefit (₹)	31,680

$$\begin{aligned}\text{Break-even point} &= \frac{\text{Avoidable fixed costs}}{\text{Incremental contribution per kg.}} = \frac{\text{₹1,58,400}}{\text{₹13.20}} \\ &= 12,000 \text{ kgs.}\end{aligned}$$

Hence further processing should be undertaken if output is expected to exceed 12,000 kgs. per week.